WHAT IS CLAIMED IS:

1. A measuring method of an electron energy distribution in a plasma region generated by application of high frequency power, comprising the steps of:

inserting a heating probe which can be heated by current flow into the plasma region;

applying a pulse voltage having a sufficient shorter period than a thermal time constant of the heating probe to maintain the heating probe in a state where the heating probe can emit thermions;

setting a state where the number of the thermions emitted sufficiently increases and the number of plasma vibrations of the emitted thermions is set to be sufficiently higher than the frequency of the high frequency power to cause the floating potential of the heating probe to follow a high frequency potential existing in the plasma;

detecting a floating potential difference between a voltage period (H level) of the pulse voltage and a no-voltage period (L level) while varying the H level of the pulse voltage; and

obtaining an electron energy distribution in the plasma region on the basis of the detected value.

2. A measuring method according to claim 1, wherein, when emission electron saturation current I_{ES} meets the following conditions of the equation, the

floating potential of the heating probe follows the high frequency potential vibration;

$$\omega_{PE}=\left(\frac{n_E \cdot e^2}{\varepsilon_0 \cdot m}\right)^{1/2}=\left(\frac{I_{ES}\cdot e}{A_p \cdot \varepsilon_0 \cdot m}\right)^{1/2}(k \cdot T_W/2\pi m)^{-1/4} \gg \omega_S \quad (1)$$

, where ω_{PE} is the number of plasma vibrations of emission electrons (electron density n_E), ε_0 is the dielectric constant in vacuum, e and m are electron charge and mass, A_P is a probe surface area, T_W is a probe temperature, and k is Boltzmann's constant.

3. A measuring method according to claim 1, wherein the pulse height (H level) the pulse voltage is increased or decreased for every 50 mV within a range of 5 to 50 volts and the floating potential difference is detected for each increase or decrease.

4. A measuring apparatus for measuring an electron energy distribution in a plasma region generated by a high frequency power, comprising:

a heating probe having a probe portion which is inserted in the plasma region to be heated by application of a pulse voltage;

a pulse power supply which applies heating pulses to the heating probe to heat the probe portion to a state that the probe portion can emit thermions;

a detecting section which detects difference in floating voltage between a voltage period (H level) and a no-voltage period (L level) of the pulse voltage; and

a calculating section which obtains an electron

energy distribution in the plasma region on the basis of the detected value detected by the detecting section.

5. A measuring apparatus according to claim 4, wherein the measuring apparatus is equipped in a processing apparatus for performing one of a film forming processing, an etching processing and an annealing processing, and

the probe portion is mounted in a chamber of the processing apparatus where the plasma region is generated, in an electrically insulated state, and the heating probe is in a potentially floating state.

6. A measuring apparatus according to claim 5, wherein the chamber is made of insulating material.

7. A measuring apparatus for measuring an electron energy distribution in a plasma region generated by a high frequency power, comprising:

a heating probe having a probe portion inserted in the plasma region to be heated by application of a pulse voltage;

a pulse power supply which applies heating pulses to the heating probe to heat the probe portion to a state that the probe portion can emit thermions;

a detecting section which comprises circuit elements integrated on a substrate and which detects difference in floating voltage between a voltage period (H level) and a no-voltage period (L level) of the pulse voltage;

an A/D converting section which is provided on the substrate along with the detecting section or on another substrate and which converts data obtained in the detecting section, to digital data;

a first signal converting section which has a function of converting an electric signal to an optical signal and vice versa and a function of performing communication and which converts the data from the A/D conversing section, to an optical signal and transmits the optical signal, or converts an optical control signal received, to an electric signal;

a second signal converting section which has a function of converting an electric signal to an optical signal and vice versa and a function of performing communication and which converts the data from the first signal converting section, to an electric signal or converts the control signal to an optical signal;

a calculating section which obtains an electron energy distribution in the plasma region on the basis of the data generated by the second signal converting section; and

a displaying section which displays a table or a graph showing the electron energy distribution obtained by the calculating section.

8. A measuring apparatus according to claim 7, which is designed to be provided in a processing apparatus for forming film, performing etching or

performing annealing, by using plasma generated by application of a pulse voltage, and in which the probe is electrically insulated from the chamber of the processing apparatus, in which the plasma region is provided, and is set at a floating potential.

9. A measuring apparatus according to claim 8, wherein the chamber is made of insulating material.